Ultraviolet and Visible Direct Solar Beam Measurements on the NASA DC-8 during the SOLVE II Mission

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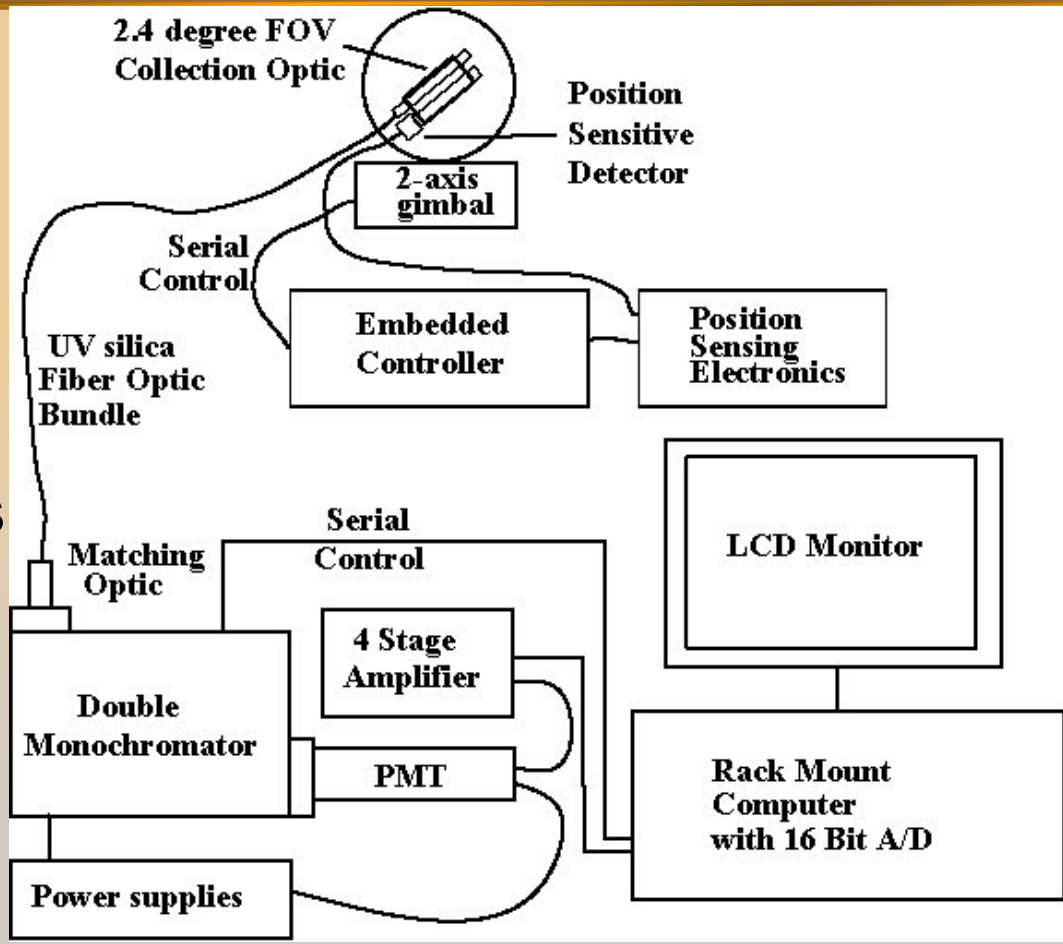
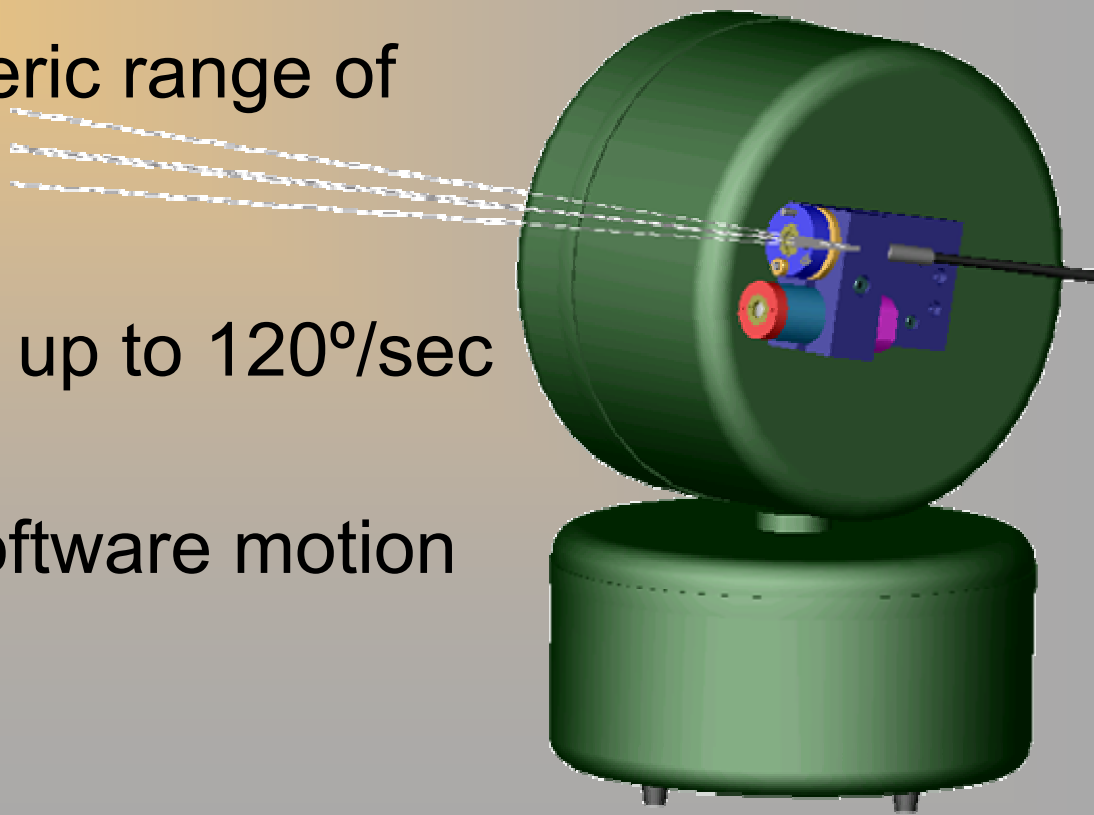
Direct Beam Irradiance Airborne Spectometer (DIAS) Instruments

- 3 Narrow FOV Input Optics
- Active Solar Tracking
- 2 Scanning Double monochromators
- 1 Fixed grating Diode array monochromator
- Data Acquisition and Control



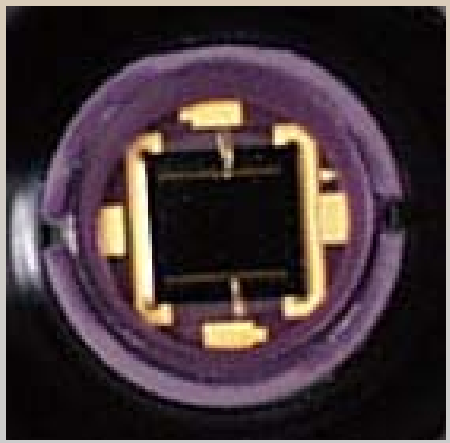
Solar Tracking – Gimbal

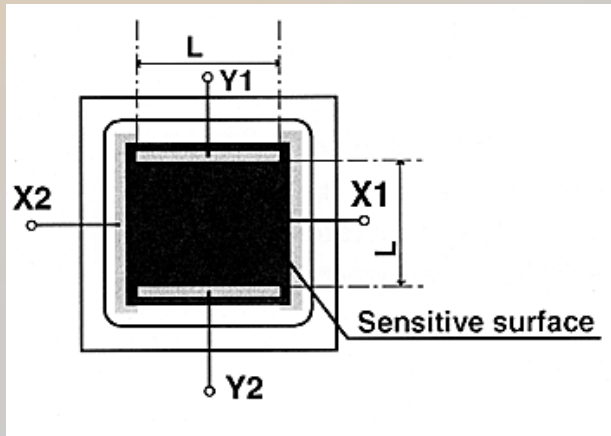
- Sagebrush Model 20 Servo 2-axis gimbal
- Full hemispheric range of motion
- Travel rate of up to 120º/sec
- Joystick or software motion control



Solar Tracking – Position Sensing Detectors

- On-Trak Photonics duolateral 2L4SP photodiodes
- 6º field of view and linked to an amplifier and display
- Position detection
- Intensity detection
- Fast, linear response
- 4 x 4 mm grid with 1 ppm resolution (≈ 6 μº with current optics)
- Static resolution ≈ 0.004º when coupled with gimbal

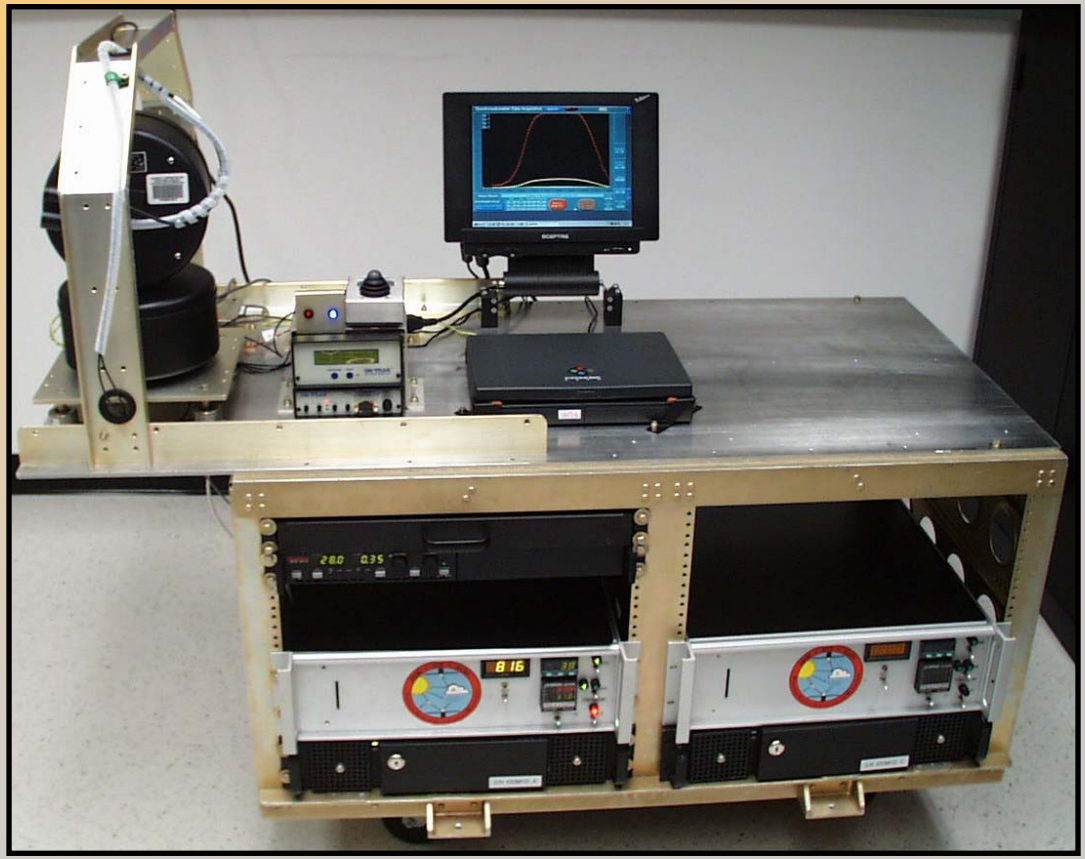




Instrument Specifications

- Narrow Field of View optics (2.4°)
- Active pointing capability to 0.01°
- Detector 1 280-650 nm, 1.0 nm FWHM, 30 second scan frequency
- Detector 2 280-750 nm, 1.0 nm FWHM, 30 second scan frequency
- Detector 3 300-700 nm, 2.4 nm FWHM, 10 second spectrum frequency

DIAS Instrument



SOLVE II DIAS rack configuration

DIAS Products

- Direct solar UV-VIS irradiance (290-750 nm)
- Ozone column (30 second frequency)
- Total Optical Depth
- 1 nm Wavelength Dependent AOD (295 – 750 nm) (30 second frequency)

$$\tau_{TOT} = \tau_{Ozone} + \tau_{Rayleigh} + \tau_{Aerosol}$$

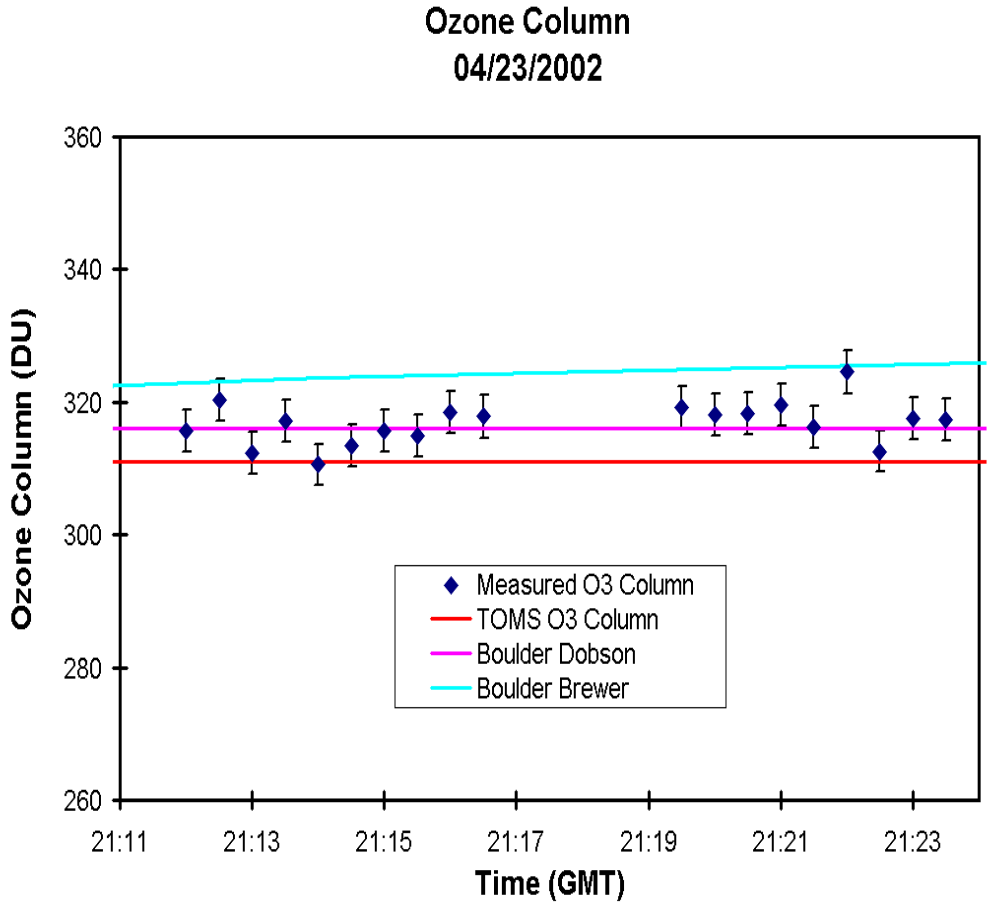
Contribution to Science Goals

- **Satellite Validation**
- Ozone column and wavelength dependent aerosol optical depths will be compared to the SAGE III instrument measurements to prove the accuracy of the satellite observations. (UV-VIS measurements)
- The 1 nm FWHM wavelength resolution of the DIAS instrument closely matches the SAGE III instrument for relevant comparisons.

Contribution to Science Goals

- **Wavelength dependent AOD data**
- We will attempt to determine absorption by polar stratospheric clouds (dependent on opportunity to observe PSCs during sun runs).
- In combination with in situ aerosol measurements may allow derivation of aerosol properties (aerosol size distributions, Angstrom coefficient)
- Direct comparisons with AATS-14 Sun photometer at 8 wavelengths <750 nm.
- Comparisons with in situ aerosol optical scattering instruments for any vertical profiles.
- Complementary with data from aerosol LIDARs

Preliminary Ozone Column Data



10 minute average of 20 second spectral data ~1.7% higher than TOMS overpass but in very good agreement with the Boulder Dobson data

Preliminary AOD Data